

# Psychological Bulletin

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## CONTENTS

### *General Review and Summary:*

*The Importance of Hunger in the Bodily Activity of the Neonate:*

T. W. RICHARDS, 817.

*Book Reviews:* 836.

*Books Received:* 847.

*Notes and News:* 849.

*Index of Volume:* 851.

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# THE PSYCHOLOGICAL BULLETIN

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## THE IMPORTANCE OF HUNGER IN THE BODILY ACTIVITY OF THE NEONATE

BY T. W. RICHARDS

*Iowa Child Welfare Research Station,  
State University of Iowa*

### BODILY ACTIVITY

In 1918 Szymanski (26, 27) showed that normally the human adult, as well as the adult dog, experiences one alternation of sleeping and waking during the course of the twenty-four-hour day, while the infant and the puppy experience several such alternations during the same period. Szymanski called the former type of cycle "mono-phasic," the latter "polyphasic." He found that lower animals were polyphasic like the infant. Kleitman and Camille (14) have more recently found that decorticate adult dogs are also polyphasic. These findings are, of course, entirely in accord with the generally accepted belief that the newborn infant is, by comparison with the adult, relatively incorticate. This belief is based on numerous lines of evidence from studies of infant behavior.

That the variations in infant activity, even in the course of the lying-in period, gradually develop into a tendency for diurnal rhythm has been demonstrated by Irwin (7). He found that bodily activity, as measured by the stabilimeter, increased relatively in proportion to the time since feeding. His infants were fed regularly throughout the day, but at night they missed one feeding. The increase in activity during the long period between feedings (8 hours) was found to be far greater than that during the shorter periods. These facts supported the popular belief that infants are most active when hungry and least active when satisfactorily fed.

Such findings would suggest that the polyphasic existence of the infant is shown both in wakefulness and in bodily activity. (These

2 conditions are, in a sense, synonymous since the judgment of wakefulness may well be made on the basis of activity.) Figure 1, from Irwin's study (7) of infants over the full ten-day period, will illustrate the increasing tendency for extreme "polyphasia" of activity to develop into a somewhat rhythmical polyphasia by the end of the lying-in period.

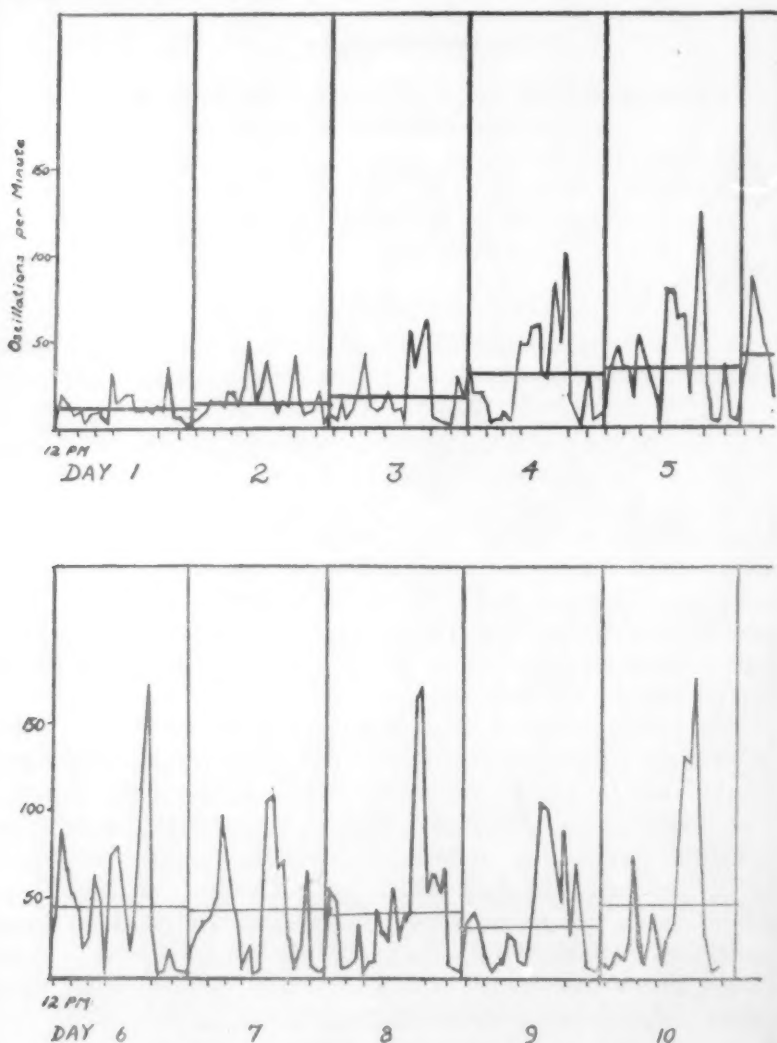


FIGURE 1. Graph of Irwin's (7) data for continuous activity of 4 infants during the first 10 days. Feeding times are indicated on the abscissa, and average activity for each day by horizontals from the ordinate.

A further study by Irwin (8) on variations of activity during the four-hour period between feedings reaffirmed the findings of his first investigation (Figure 3, p. 828).

Irwin and Weiss (12) showed that the increase in activity between 2 feedings occurred also in relative darkness. Activity in darkness was greater than in dim light (Weiss, 31). Irwin and Weiss attributed this to greater sensitivity of the dark-adapted eye.

#### GASTRIC ACTIVITY

In 1915 Carlson and Ginsburg (4) and Ginsburg, Tumpowsky, and Carlson (6), showed that the violent contractions of the stomach, which in adults were coincident with the sensation of "hunger," were demonstrable in infants. Shortly thereafter Taylor (29) reported similar findings on a larger group of infants. This work, together with that of Patterson on dogs (16, 17, 18), showed (1) that

TABLE 1  
TIME OF APPEARANCE OF STOMACH CONTRACTIONS AFTER FEEDING

Author	Infants	Age, Days	Minutes	
			Mean	Range
Carlson and Ginsburg.....	30	{ 1 to 14	160	140 to 210
		{ 7 to 36	100	40 to 140
Taylor.....	56	{ 8 to 12	170	120 to 240
		{ 18 to 120	220	192 to 275
Peiper and Isbert.....				60+

the contractions of the youthful stomach were more frequent than those of the older stomach, and (2) that periods of contraction lasted longer and followed each other more closely. Peiper and Isbert (19) used 2 balloons placed in different parts of the stomach to show that the "hunger contractions" were peristaltic waves of great amplitude.

These investigations showed that gastric contractions appeared no sooner than an hour after feeding. This finding is upheld in the above tabulation, which presents the mean time and the range for the first appearance of a period of stomach contractions for the infants studied. Carlson and Ginsburg (4) used premature infants while Taylor (29) used full-term infants.

As exemplary of the findings, the following statements are quoted from the original paper of Carlson and Ginsburg (4):

"Periods of gastric tonus and hunger contractions are in evidence shortly after birth and before any food has entered the stomach. These gastric hunger periods exhibit all the peculiarities of the gastric hunger contractions of the

adult, except that the periods of motor quiescence of the stomach between the hunger periods are on the whole much shorter (10-15 minutes). When the gastric hunger contractions become very vigorous the sleeping infant may show some restlessness, and even wake up and cry. If the infant is awake the very vigorous hunger contractions frequently induce crying and restlessness.<sup>1</sup> Two tracings showing typical hunger periods in a nine-hour-old infant before first nursing, and in a nine-day-old infant three hours after nursing . . . [are shown]. The reader's attention is called to the fact that in both of these infants the gastric hunger periods end in incomplete tetanus, an index of youth, and vigorous stomach" (4, pp. 31-32).

With respect to the problem of the motility of the stomach in relation to time since feeding, we may quote from Ginsburg, Tumpowsky, and Carlson (6):

"The average time between nursing and the appearance of the period of hunger contractions was two hours and forty minutes, with a maximum of three hours and thirty minutes, and a minimum of two hours and twenty minutes [160' (140'-210')].

"Our tracings show that when the stomach is full of food the inflated balloon in the fundus reveals practically no contractions. As the stomach gradually empties, feeble tonus contractions appear, and increase in rate and intensity until they end in a period of typical hunger contractions from two and a half to three hours after the previous nursing. This change of the tonus contractions of the fundic end of the stomach partly filled with food into the hunger contractions of the empty stomach have [has] already been demonstrated for the adult by Rogers and Hardt.<sup>2</sup> Pisek and LeWald<sup>3</sup> have shown by roentgenogram experiments that 'three hours is practically the emptying time of a child's stomach and often less than that'" (6, p. 1822).

Taylor (29) states that the first period of contraction is not as long or as vigorous as those subsequent to it. It consists of from 5 to 20 separate contractions and lasts from 2 to 8 minutes. The succeeding periods of contraction, appearing in perhaps 20 minutes, may last from 30 minutes to 1 hour or longer. Each contraction lasts about 20 seconds. In some infants very strong contractions (particularly in those periods which end in partial tetanus) may last but 18 seconds. This ending of the period in tetanus is frequent except in the case of the first period after nursing. Single contractions are usually of sufficient force to raise the column of bromo

<sup>1</sup> It is interesting in this connection to note that in their second publication (6, p. 1822) Carlson and Ginsburg, with Tumpowsky, state, "The accompanying tracings were obtained from infants who were asleep or otherwise quiet, since inhibition of the hunger contractions results when the child is restless."

<sup>2</sup> Rogers and Hardt: *Amer. J. Physiol.*, 1915, 36, 354.

<sup>3</sup> Pisek and LeWald: *Infant. Stomach, Tr. of Am. Pediat. Soc.*, 1913, 25, 150.

from 2 to 3 cm., but during a partial tetanus it may be raised as high as 5 cm.

Taylor found almost continuous contraction of the stomach in a young premature (1,510 grams) 40 minutes after a feeding of 15 grams from the breast. The individual contractions required about the same length of time for their completion (2 to 3 minutes), and were as powerful as those of the normal infant. Partial tetanus was frequent. Nine days later when the infant had more food, despite lack of weight gain, gastric motility after 5 hours was like that of normal infants.

For a given infant the time for emptying of the stomach was found to be fairly constant over a short period of time provided quantity and type of food were not changed. In cases of chronic nutritional disturbances and of poorly tolerated foods contractions appeared sooner than in normal cases, indeed before the stomach was empty. All investigators of the gastric motility of infants have found, in addition to or basic to stomach contractions, tonus changes in the stomach which may vary so as to give a rising tonus as time since previous nursing increases.

From these data with respect to the gastric activity of the human infant we may conclude that there may be a rising gastric tonus, somewhat continuous from the time the stomach is filled until it is relatively empty, at which time rhythmical powerful contractions appear to be superimposed. These may occur as early as 2 hours after feeding; they are usually established from 2½ to 3 hours after feeding. The contractions, coming in periods, are more frequent and stronger than are adult "hunger" contractions, and appear to be strong waves of peristalsis.

As far as we know, only 3 experimenters have measured simultaneously the activity of both the stomach and the body.

Powelson (21) transplanted the stomachs of young albino rats in such a way as to make the walls of the stomach visible through the skin of the animal. He recorded the movements objectively by pressing a signal key when the stomach moved. The movements of the stomach were recorded simultaneously with bodily activity pneumographically recorded on a kymograph. He reported results as follows:

"A fairly high correlation between muscular movements and gastric peristalsis as postulated by Richter (Richter, C. P., *A Behavioristic Study of the Activity of the Rat. Comp. Psychol. Monog.*, 1922, 1, No. 2. Pp. 55) is evident. Frequently in the quiescent animal gastric contractions become shallow or apparently entirely cease. These suddenly become deeper, whereupon

the animal at once arouses to activity and carries out sundry movements, such as washing or scratching. More frequently, however, it has been observed that muscular activity immediately precedes rather than follows augmented gastric motility" (21, p. 248).

Wada (30) reports results of the measurement of gastric and bodily motility of 3 adult subjects. She used a tambour, with metal disc attached, which was placed under the bed springs so that it was sensitive to movements of the subject lying on the bed. Movements were transmitted pneumatically to a kymograph, upon which gastric movements were also transmitted, from a balloon within the stomach. Wada states: "There were numerous bodily movements during the contraction periods, while practically none of them appeared at quiescent times" (30, p. 30).

Richards and Holcomb (24) have measured contractions of the stomach simultaneously with the bodily activity of 2 puppies. The

TABLE 2  
PERCENTAGE OF TIME DURING WHICH GASTRIC AND BODILY ACTIVITY OCCURRED  
IN TWO MALE PUPPIES THREE WEEKS OLD

Dog Number	Time Since Feeding (Minutes)	Length Period (Minutes)	Per Cent Activity		Per Cent of Time Activity Related		
			Bodily	Gastric	Similar	Bodily Greater	Gastric Greater
1	97	14	72	74	84.5	5.2	10.3
2	113	14	68	70	83.0	1.0	16.0
1	152	16	46	34	83.7	14.7	1.6
2	197	34	44	48	90.6	.7	8.7
1	243	17	66	60	75.5	17.0	7.5

balloon method was used, recording being made on a kymograph by means of a float in a bromoform manometer. Bodily activity was measured by means of a stabilimeter composed of an aluminum pan suspended from 4 springs within a large box. The 2 male puppies were studied at the age of 3 weeks. From the records, both gastric and bodily activity were estimated as being slight, medium, or great for any fifteen-second interval. In this way it was possible to determine roughly the coincidence of these forms of activity. The results obtained appear in Table 2.

For both puppies the degree of gastric and bodily activity at various periods after feeding coincided in from 76% to 91% of intervals; this would, of course, indicate relative simultaneity for these phenomena. Although there were only 2 puppies and, therefore, satisfactory analysis of the data was impossible, there was slight suggestion of an increase in either gastric or bodily activity with an

increase in length of period since previous feeding. Apparently other factors were influential in these individual cases, which resulted in activity unlike that obtained for infants.

This lack of similarity may be due to the fact that the earliest experimental periods with the puppies were begun at least 2 hours after feeding, at a time when gastric activity was fairly great. Again, 2 hours after feeding in the young dog may not be comparable to a similar time in the schedule of the human infant, since the size of the puppy's stomach is much smaller and hence its emptying time should be far less. It was necessary to restrain the puppies by placing them in a box within the pan, thus hampering their movements. It is entirely possible that activity may have been excited by this procedure to a greater extent than occurred in the cases of human infants for whom the stabilimeter should represent a fairly normal environment. Indeed, it was the impression of the experimenters that this adaptive factor in the case of the puppies was of no slight importance, since they noticed in preliminary experiments a tendency for activity to decrease after what appeared to be an initial period of adjustment to the experimental situation.

On the basis of his own work and that of Carlson and Ginsburg (4), Irwin (7) concluded that the increment in activity between 2 nursings may be due to gastric stimuli arising from changes in gastric tonus or from the "hunger" contractions themselves.

Pratt (22) believes that the "spontaneous movements" such as observed by Irwin when stimuli were relatively at a minimum "have been shown to arise largely from gastro-intestinal activity. . . . It seems probable that activity of the digestive tract brings into play most of the behavior mechanisms which have thus far developed" (22, p. 199).

Due to the impossibility of demonstrating satisfactorily whether or not gastric tonus rises regularly with time since feeding, it is impossible to correlate this variable with the rise of activity. On the other hand, that the stomach contractions themselves cause the activity is unlikely for 2 reasons: (1) "Hunger" contractions make their first appearance long after bodily activity has started to increase. (2) Unlike bodily activity they occur periodically. It is certain, however, that both bodily activity and gastric motility increase during the period between nursings.

Eckstein and Paffrath (5), who also measured bodily activity objectively, could recognize no characteristic effect of hunger or of bed wetting. That this result differs from the findings of Irwin may be explained (1) as possibly due to the short interfeeding interval, and (2) by the possibility that the five-point scale used in designating

bodily activity was too crude a measure to catch intra-hourly variations within a two-hour period, and with a group is not a sufficiently delicate index of the activity differential. It should be noted also (3) that the authors report only controls of temperature; external stimuli of all sorts may have distorted the results of the experiment as compared with that of Irwin. (4) The infants studied by Eckstein and Paffrath were largely prematures; this may have been operative in giving results varying with Irwin's.

#### GASTRIC ACTIVITY AND BLOOD SUGAR

A large amount of experimental work, mainly on dogs, has indicated the close relationship between level of blood sugar and the appearance of gastric activity. This evidence has been summarized recently by Patterson (18). It appears that blood sugar may well affect gastric motility, but that the precise nature of this effect is subject to neural modification (in mammals via splanchnics and vagi).

Let us now examine the evidence for believing that stomach contractions in the newborn infant may be due to lowered blood sugar. Recent reports by Nervi (15), Schretter and Nevinny (25), and Winter (32) show that level of blood sugar in the newborn infant is slightly if at all below that of the adult. As with the adult, blood sugar varies from day to day in the individual infant and from one infant to another. The blood sugar curve following feeding is also variable between infants, indicating variation in the assimilability of carbohydrate.<sup>4</sup>

Winter's (32) curves for the concentration of blood sugar with respect (1) to the first meal and (2) to other meals during the same period of life, show that blood sugar following the first meal after birth shows a more rapid rise and descent than it does after other meals. The peak is reached in 15 minutes, and by slightly more than an hour the original fasting level is attained. In the case of the

<sup>4</sup> In this connection it is interesting to note that Irwin (11) reports a coefficient of  $-0.02 \pm 0.08$  between bodily activity of 73 infants measured as oscillations per minute of the stabilimeter and intestinal surface as indicated by the von Pirquet formula (20) [(sitting height)<sup>2</sup>]. The speed with which carbohydrate is absorbed probably varies with intestinal surface. Though the latter, as indicated by this formula, appears not to correlate with bodily activity, it would be interesting to note whether or not both speed of absorption of carbohydrate and intestinal surface might not correlate features of activity such as the rate of increase in activity since feeding or the degree of constancy of this acceleration.

subsequent meals, the blood sugar curve rises gradually for 30 minutes. At 60 minutes the peak is reached; within another 30 minutes the curve has descended practically to the fasting level, at which it remains, apparently, until the next feeding, if this occurs within a few hours.

We have seen that the contraction of the stomach in infants appears about  $2\frac{1}{2}$  to 3 hours after feeding, and that the drop in blood sugar level following the rise after feeding has taken place 90 minutes after feeding. To establish the theory that this drop is the cause of the contractions would, first of all, require that the drop occur before the contractions began in every infant of a large group. Unfortunately this experiment has never been performed. Further, should the experiment give positive results, it would be necessary to explain the interval of time between the return to post-absorptive level of blood sugar and the beginning of the first contraction period. We should ourselves guess that this interval would clearly emerge from the data. It is entirely plausible that the drop in blood sugar does not cause the contractions directly, but may be an important factor in initiating a series of physiological processes which result in gastric motility of the violent type.

It is obvious that the sharp rise and fall of the blood sugar curves is indicative only of the conversion and absorption of carbohydrate as dextrose in the stomach and small intestine, and of carbohydrate metabolism in only an extremely superficial way. Blood sugar level in itself cannot be regarded as an indicator of the nutritive state of the organism. Thus, aside from the dissimilarity between the blood sugar drop and the increment in activity, it is unreasonable to suppose that decrease in blood sugar may be etiological in bodily activity any more than in initiating contractions of the stomach.

#### SUCKING ACTIVITY

Evidence from studies of the sucking responses (2, 23, 13) suggests that the specificity with which this reaction may be used as a criterion of differentiation between stimuli is greatest (1) when the infant is hungry but (2) sufficiently soon after the initiation of nursing to warrant the entrance of food in the stomach. The contractions of the stomach are then inhibited. Jensen (13) claims that the partially full infant can discriminate between materials fed to him better than can the hungry or satiated infant.

## SLEEP

Although the physiology of sleep, particularly of infant sleep, is an elusive subject in itself, various approaches to it have been made. Unfortunately, they have yielded little but a variety of statistics as to the amount of time devoted to sleep, the depth of sleep, length of periods, etc., plus a few isolated observations made incidentally in the course of experiments dealing with other features of physiology.

The relation of stomach contraction to sleep has been determined with adults by Carlson (3), Wada (30), and others. It appears that the adult is not necessarily awakened by the contractions. In explanation of their illustrations, Ginsburg, Tumpowsky, and Carlson (6, p. 1822) stated that "the accompanying tracings were obtained from infants who were asleep or otherwise quiet, since

TABLE 3  
*Percentage of Sleeping Time*  
(Bühler, 1, p. 130)

Age, Months	Cases	Per Cent of Time Asleep	Age, Months	Cases	Per Cent of Time Asleep
0	4	80.2	7	5	50.4
1	7	64.5	8	6	55.4
2	5	60.0	9	5	53.2
3	6	55.6	10	5	45.2
4	6	61.3	11	5	51.6
5	5	48.6	12	5	51.2
6	5	53.1			

inhibition of the hunger contractions results when the child is restless." On the other hand, Carlson (3, p. 41), speaking of infants, reports: "When the gastric hunger contractions become very vigorous the sleeping infant may show some restlessness, and may even wake up and cry. If the infant is awake the very vigorous contractions frequently induce crying and restlessness."

Taylor (29), from the opposite viewpoint, believes a strong argument against the theory that hunger contractions may induce violent activity (crying) is that stomach contractions occur during continued sleep in infants and seem to have little effect on the sleep. Indeed, most of the evidence of contractions of the stomach of the infant was gathered with sleeping infants. It is difficult to understand just how contractions, on the one hand, may occur during sleeping as well as waking yet induce waking through activity, and, in turn, be inhibited by this waking and activity. That the problem needs experimental elucidation should be obvious.

It is a common observation that infants spend more time sleeping than do adults. The figures of Bühler (1, p. 130) on the percentage of sleeping time during the first year at each month show that there is a rapid decrease in the initial year.<sup>5</sup>

There appears to be a drop in the amount of sleep from 80% during the first month to about 50% at the sixth month, after which it remains at approximately that figure.

For our purposes it is interesting to know how the sleep of the newborn infant is distributed over the three-hour interfeeding period. Irwin's (8) data may be used in this connection. At a given observation period he calculated the percentage of infants who slept during

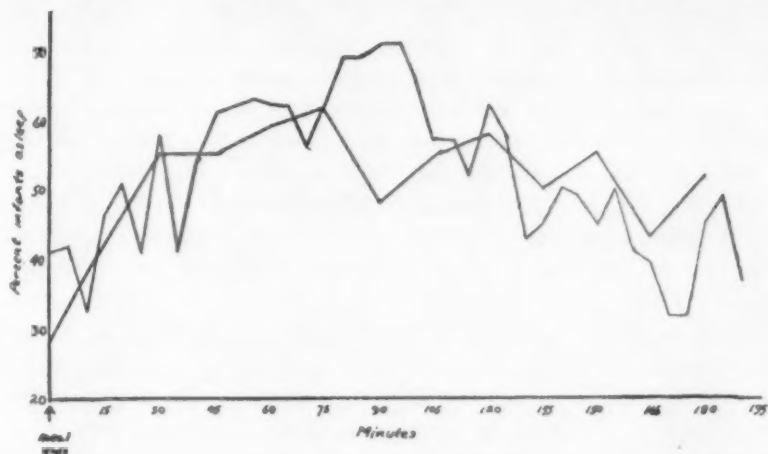


FIGURE 2. Percentages of infants asleep at times since feeding.  
After data of Irwin (8).

the three-hour period. One group of 31 infants was observed every 15 minutes, the other group of 42 every 5 minutes. It will be apparent from Figure 2 that the curves are superimposed.

Contrary to the popular belief that most infants sleep immediately after feeding and fewest at the end of the sleeping period, it would appear that in a large group as many of the infants (30% to 40%) sleep during the early part of the period as during the later part; most of the infants (50% to 70%) are asleep during the middle of the period, from 45 minutes to 1 hour and 45 minutes after nursing. These percentages are, of course, based on the percentage of the group asleep at any one interval of observation. We cannot say that

<sup>5</sup> Calculated in  $\frac{\text{minutes slept}}{24 \times 60} \times 100$  averaged for the month.

any one infant or certain infants slept early and awoke later, or *vice versa*, because this is not in the data. It is, of course, conceivable that sleep in the early part of the period may be due to some sedative effect of feeding peculiar to a few infants, while sleep in the later part of the period may be due to fatigue after unusual activity of some sort. On the other hand, early wakefulness may be due to the stimulation coincident with nursing or of being placed in the stabilimeter; late waking may be caused by organic needs of the organism, such as "hunger."

The fact still remains, however, that more of the infants sleep at some time during the middle of the period than at its beginning or

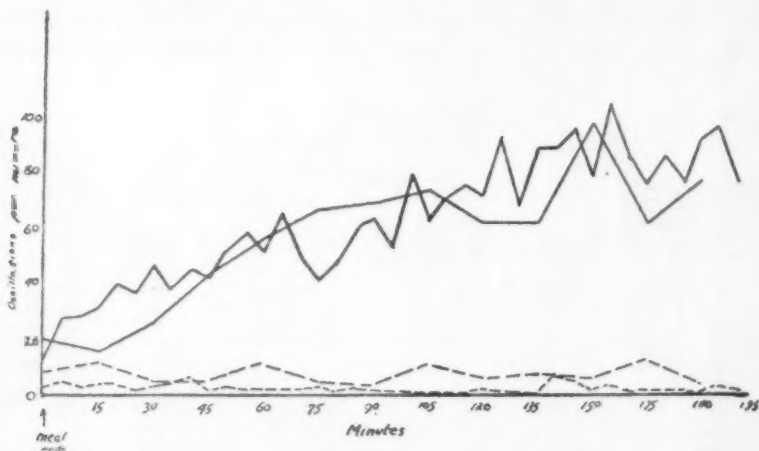


FIGURE 3. Activity of newborn infant asleep indicated by dash, and awake, solid line, at times since feeding. After Irwin (8).

end. It would thus appear that "hunger," as deduced empirically from time since feeding, certainly cannot be regarded as the sole, or even the most important, factor in inducing waking in infants, even under conditions of minimal external stimulation.

When Irwin's (8) curves of activity for sleeping<sup>6</sup> and for waking infants during the three-hour period between feedings are compared (Figure 3), we find that about 3% to 10% of sleepers are active throughout the period, while the percentages of infants awake climb from about 20% at the beginning of the period to from 70% to 95% at its termination.

<sup>6</sup> Conclusions based upon data regarding activity during sleep are doubtful since one of the criteria in judging sleep is undoubtedly a minimum of bodily activity.

It has been shown in the preceding pages that there are rarely less than 40% and rarely more than 60% of infants awake. Also the low percentage of waking occurs at the middle of the period. We may thus conclude that although more infants are awake during the early part of the period, they are but slightly active, while the fewer awake at the middle of the period (from 45 minutes to 1 hour and 45 minutes) are about twice as active. During the late part of the period more infants are awake and very active. It should be kept in mind that even at this period 40% are asleep and are extremely inactive.

These results regarding sleep, activity, and stomach contractions may be interpreted in 3 ways. (1) Stomach contractions may occur in all infants at some time before or near the end of the three-hour period, but apparently they do not cause waking in at least 40% of infants. (2) Stomach contractions may not occur at this time in at least 40% of the cases and therefore cannot cause waking. (3) The last possibility is that stomach contractions normally occur and cause waking in infants when the stomach is sufficiently empty. The fact that they do not wake all infants at the same time may be due to the possibility that they occur relatively early in the period in some infants, bringing about activity; the activity, in turn, causes a fatigue which acts as a sedative—thus either inhibiting the effect of the contractions (that is, activity), or inhibiting the contractions themselves. The answer to this question is an experimental problem.

The fact that older infants, developing an increasingly patternized polyphasia in the sense of Szymanski, appear to sleep soundly during a night period of as much as 12 hours' duration would suggest that even if gastric motility does induce waking and activity, this relationship may be dominated by other features, such as "habits" engendered by training.

#### EFFECT OF EXTERNAL STIMULI

Much has been written of the effect of external stimuli on the behavior of the newborn infant. Unfortunately, despite Pratt (22), little of this material is of importance here because the time since previous feeding either was not noted or was not controlled.

In a recent review of the literature regarding infant behavior, Pratt states:

"The relation between ease of eliciting the response and the state of the organism was observed early. Poli<sup>7</sup> found the cochlear-palpebral reflex

<sup>7</sup> Poli, C.: L'udito nei neonati. (*Arch ital, di otol.*, 1893, 1, 358-364.) [Abst. in *Arch. f. Ohrenhk.*, 1896, 41, 82.]

easiest to elicit when the child was asleep and hardest when nursing. Practically all investigators have observed the necessity for a comparatively quiescent state in order to detect respiratory and circulatory changes and to evoke the 'fear' reaction" (22, p. 179).

As a whole, Pratt is of the opinion that "reflex excitability mounts with increase of stomach contractions" (22, p. 173). Sleep which, to him, is apparently an "inhibition of the gastro-intestinally aroused general activity facilitates the study of reactions to specific stimuli even though imitability may not be great. It is significant that almost all studies of infants have been made under this condition" (22, p. 195).

Patterson (18) showed that the gastric activity of adult frogs was inhibited by crude light stimuli. This effect was shown by vagotomized frogs and even slightly by splanchnicotomized animals, but could not be demonstrated in decerebrated frogs.

Taylor (29) stimulated the infant with various foodstuffs introduced orally or directly into the stomach. His experiments showed that of lemon juice, common salt, breast milk, quinine, and sugar water none had any effect excepting sugar water in a "transitory inhibition." Ginsburg, Tumpowsky, and Carlson (6) noted that restlessness inhibited the contractions of the empty stomach.

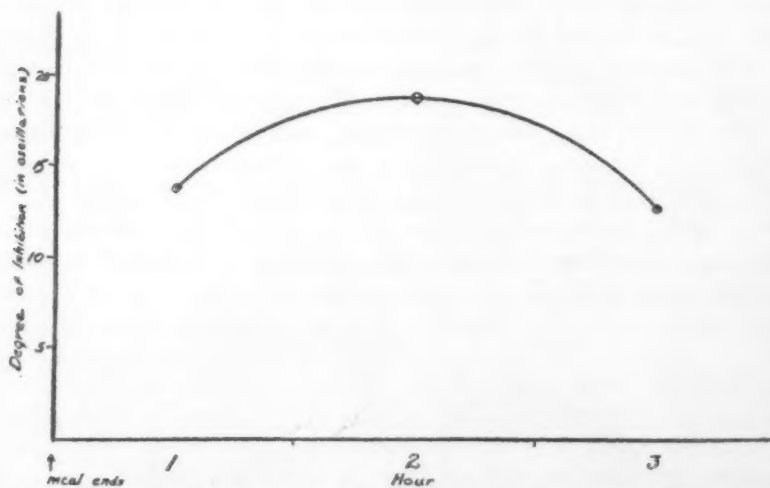


FIGURE 4. Inhibition of activity of newborn infants, expressed by decrease in activity due to increasing light intensity, at times since feeding. From data of Weiss (31).

Weiss (31) has shown (1) that light (at least of the moderate intensities used in her study) tends to inhibit activity, and (2) that this effect is significantly greater about an hour and a half after

feeding or between feeding periods. Figure 4 shows the inhibitory effect of light. The interesting parallel between the shape of the curve in Figure 4 and that for percentage of infants asleep during the three-hour period (as shown in Irwin's curves on page 827) suggests that the inhibition of activity may be characteristic of or a function of sleeping. Weiss showed that this is not the case by determining the mean inhibitory effect with groups asleep, awake, and awake and crying. The results <sup>a</sup> are shown in Table 4.

TABLE 4  
DECREASE IN STABILIMETER OSCILLATIONS PER ONE-HALF MINUTE DUE  
TO INCREASE IN LIGHT INTENSITY

Condition	Cases	Inhibitory Effect
Asleep.....	11	2.3
Awake.....	43	17.4
Awake and Crying.....	36	22.9

The difference between the group asleep and the group awake and crying was not significant, but each of these groups differed significantly from the group asleep. We may assume that, although most infants are asleep during the middle of the interfeeding period, the infants awake are inhibited to a greater extent at this time than at any other time during the period. That the effect of this inhibition may be sleep is, of course, entirely possible.

In another study Irwin and Weiss (12) found that activity even in darkness increased as the time since previous feeding increased. Under conditions of light for 5 minutes after a half hour of darkness it was found that activity increased with time since feeding under .002 and 3.9 foot candles. It decreased, however, under .02 foot candles, a phenomenon which we cannot at present explain.

#### CONCLUSION

The bulk of evidence regarding infant behavior under various conditions has suggested to many that as time since feeding elapses the infant becomes more irritable, more active, and less subject to

<sup>a</sup> The possibility should be kept in mind that the amount of activity shown by any one group would in part limit the decrease of activity due to stimulation. For this reason the inhibitory effect should perhaps be calculated as a percentage of the total amount for any one group. For example, a mean decrease of 2.3 oscillations per minute in sleepers producing 7 oscillations per minute would represent a decrease of about  $33\frac{1}{3}\%$ ; a decrease of 20 oscillations per minute in infants awake giving an average of 60 oscillations per minute would also represent a decrease in activity of  $33\frac{1}{3}\%$ .

inhibition by external stimulation. This viewpoint has been summarized by Pratt (22). Pratt believes that the mounting vigor of each contraction period induces a qualitative spread of movements over the whole musculature as well as a quantitative increase in activity.

We have seen that the early and late parts of the interval between feedings are characterized by relatively increased thresholds both to exciting and inhibitory stimuli. A better way to state the situation is to say that the effects of external stimuli, whether excitatory or inhibitory, are low at these periods. In the early period there is slight activity to be altered by external stimulation; in the later period there is much activity to be altered.

During the middle part of the period excitability is significantly greater than during the early or late parts. It is at this time that stimuli are most effective in stimulating or in inhibiting activity. The thresholds seem to be lowered. Sleep is most frequent in this period. If we are to assume that gastro-intestinal phenomena control these phasic phenomena, we should have to agree not only that emptiness of the stomach induces great bodily activity and that these effects dominate the effects of other types of stimulation, but also that distention of the stomach inhibits activity and precludes the effect of other stimuli. The dominance of this gastro-intestinal inhibition gives way as the time since feeding elapses, so that the thresholds for other external stimuli are lowered.

Perhaps because of an added inhibitory effect, that is, from external stimuli of moderate intensities and durations longer than the period required for adaptation, sleep is engendered or simply characterizes the inhibition of activity. Gradually, however, following absorption of the meal, activity is increased due to growing need of nourishment. Whether this need is expressed as gastric activity, humorally, or otherwise, it is likely that one of these phenomena or a combination of them induces an increment in bodily activity.

The effect of external stimuli in exciting further activity is masked by that already present (except for feeding responses, for example, sucking). Apparently, too, the threshold for external stimuli of inhibitory nature is somehow raised, so that these stimuli have less quieting effect. The infant is hungry, and its behavior is the result of the time that has elapsed since the last feeding. During this time many physiological changes have followed a definite course, to which both the increase in activity and the growing vigor of tonic and peristaltic phenomena in the gastro-intestinal system run parallel.

SUMMARY

1. Bodily activity appears to increase in a curve of positive acceleration during a 3 to 4 hour period between feedings.

2. Early in this period blood sugar level rises and falls back again to its former level.

3. In general, following some time after the fall in blood sugar, the stomach demonstrates rhythmic violent contractions comparable to the contractions of "hunger" in adults.

4. These contractions may be due to decrease in level of blood sugar, but it is not unlikely that other factors enter into their genesis. As demonstrated with infants at present, there is not a 1 to 1 ratio between level of blood sugar and activity of the stomach.

5. Neither blood sugar levels nor gastric contractions are assumed to be simple determinants of increment in bodily activity. In sleep each may vary yet induce no differential in activity.

6. Sleep appears to be common to most infants in the middle of the period between feedings, and to characterize the activity of about 40% of infants both at the beginning of the period and at the end.

7. There is some evidence that external stimuli are least effective as determinants of activity (a) when the infant is relatively at rest (soon after feeding) and (b) when the infant is very restless (3 hours or more after feeding). Effects may be greatest during the middle of the period, although it is at this time that most infants are asleep.

Light stimuli of moderate intensities over long periods appear to inhibit activity of infants least at the beginning and end of the period between feedings, and most at the middle of the period. Perhaps this inhibitory tendency manifests itself in sleep, for the curves are somewhat parallel.

A general conclusion to this short review of material regarding hunger in the newborn infant would be that food supply directly induces lowered bodily activity; this is brought about either through filling of the stomach or through supply of food materials to the tissues. The neurology of this phenomenon is not explained. As time since feeding increases, the stomach and intestines gradually empty, and concomitant with these phenomena is an increase in positive acceleration of bodily activity. This activity is in part made possible by food supply, but is materially increased as the food supply becomes exhausted. Violent waves of peristalsis, whether occurring as the result of lowered blood sugar or other humoral agents, seem invariably to occur some time after the first hour following feeding and may add to the bodily activity already present. However, the

infant may sleep at any time during the cycle, perhaps early due to satiety and later due to fatigue. In the middle of the three-hour period the infants seem most prone to sleep, and those awake most responsive to external stimulation of an inhibitive sort. External stimuli are less effective immediately after feeding, during the absorptive period, and during the later period of violent activity both of the body and the stomach and of "hunger."

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## BOOK REVIEWS

SKINNER, C. E., (Editor), *Educational Psychology*. New York: Prentice-Hall, Inc., 1936. Pp. xxvi+754.

Dr. Skinner has presented here another well-edited book written by twenty-three authors. The material chosen covers a wider range than many of the earlier educational psychologies and emphasizes the social and descriptive phases as opposed to the statistical and experimental phases of education. The result gives somewhat of a moralizing exhortative impression rather than of the presentation of specific factual contents of established knowledge, although many experimental results are used in the conclusions.

The editor asserts that the end of education is to guide "the individual, the plastic material that is being developed or changed so that he can take his place in a changing social order. Personality that is wholesome and developing is the goal of our efforts. Curricular material, methods and agencies are but means to that end; namely a person that is socially and individually efficient, serviceable, and happy."

The volume distinguishes four part problems: growth, learning, individual differences and their measurements, adjustment and guidance. Growth is made to cover a number of special capacities, some of which include learning. Thus the second topic is Acquisition of Skills and Knowledge, the fourth Reflective Thinking or Problem Solving. Expression and Creative Activity, Motivation, as well as the Development of the Emotions, Social Growth and Character Formation, Personality Development, and Childhood and Adolescence are included.

There is in several of these sections considerable repetition. Expression and Creative Activity and Motivation overlap to a considerable degree in the material offered, as do the chapters on Character and on Personality. The chapter on Adolescence touches on most that have gone before. The conclusions are consistent and it is a question whether the repetition is greater in amount than is necessary to insure thorough understanding and adequate retention.

More concrete is the material given in the section on Learning. Even here more time might be given to the results of experimental work and more topics introduced. No reference is made to the inhi-

bitions or to the effect of intention among other factors. The curves of learning and retention, the will to learn, active repetition, whole and part learning, and distributed repetitions receive the major emphasis. An interesting slip by Professor Davis in this section is the statement that recognition is less easy than recall. This is based on the smaller percentage of material recognized and overlooks the fact that experiments in recognition use one repetition for the original presentation, while for the relearning method of obtaining the retention curve, the material is completely learned, with twelve or more repetitions for the original presentation.

Dr. Webb gives a very satisfactory statement of the present position of transfer of training. The chapter on "Learning Fundamental School Subjects" suffers from lack of space. So much is covered that each topic can be given only a very brief survey. This must be confined to the most general principles and since these are approximately the same for each subject, considerable repetition results. One has a somewhat restricted statement of the actual methods.

"Individual Differences," by Freeman, and "Intelligence," by Witty, are both comprehensive but also show a considerable repetition, since we know most about intelligence of all the different ways in which people may vary. Witty gives a ten-page table of tests with the essential data. It should prove valuable. "Educational Measurements," by Lincoln, and "Subject Disabilities," by Wood, might easily duplicate each other but Wood sticks pretty closely to the correction side with only incidental reference to the methods of measurement. In "Teacher Evaluation," Gifford discusses mainly the different forms of examination and of grading. The new type examinations are submitted to a careful criticism of their demerits as well as merits, and the conclusion is reached that they should be used with caution. Grades are to be subordinated to personal estimates, and reports to parents are to approach clinical diagnosis.

The section on Adjustment and Guidance has chapters by Rock, Wallin, and Moss which present the theories and points of attack of each on the problems of mental abnormality and mental hygiene. It is interesting to note the differences in approach and in conclusions offered by the three men. Taken together they give a valuable presentation of the subject.

Washburne's "Viewpoints in Educational Psychology" presents the attitude that some of the general psychological schools might be expected to take towards the problems of education. They are

somewhat freely interpreted as for example when the Behaviorist and Gestaltist are made to use the notion of attention which they both, of course, have avowedly repudiated. Any attempt to give a Gestalt theory of learning must be somewhat uncritical until that school admits learning to its categories. As a free translation of the attitude of the different schools, the statements may be accepted.

Any review of so comprehensive and varied a treatment of education must be incomplete and unsatisfactory. As a whole, the book gives a good survey of the present status of psychology as applied to education. It tends to be rather a series of precepts for the teacher's use in practice, based upon the results of psychology, than a statement of the methods and results of psychology that might bear on education. This probably will prove more interesting and valuable to the teacher than a more formal and *soi disant* scientific treatment. It is well and interestingly written.

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DOLLARD, J., *Criteria for the Life History*. New Haven: Yale University Press, 1935. Pp. v+288.

This book is a significant and ingenious attempt to analyze and compare recent clinical studies and schools. The author is what might be called a psycho-sociologist or perhaps a socio-psychologist, although I believe that his original training was in the field of sociology and it is in that field that his most trenchant criticisms reside. Dollard is an Associate in the Yale Institute of Human Relations and this book is a project which was initiated by a sub-committee of the Committee on Culture and Personality of the Social Science Research Council and may be thought of as one of the Social Science Research Council projects.

The book briefly described sets up seven criteria for judging a life history and then proceeds to apply these criteria to case studies or life histories by Adler, Taft, who is a representative of Rank, and Freud, representing the schools of psychotherapy, W. I. Thomas and Znaniecki, and Shaw representing the sociological approach, and H. G. Wells whose autobiography was selected as a representative of that form of biography. Dollard did not unwittingly slight Jung but makes his apologies for not including a critique of Jung's point of view because of the difficulty of finding a suitable life history representative of the Jungian School. The seven criteria are as follows:

- I. The subject must be viewed as a specimen in a cultural series.
- II. The organic motors of action ascribed must be socially relevant.
- III. The peculiar rôle of the family group in transmitting the culture must be recognized.
- IV. The specific method of elaboration of organic materials into social behavior must be shown.
- V. The continuous related character of experience from childhood through adulthood must be stressed.
- VI. The "social situation" must be carefully and continuously specified as a factor.
- VII. The life-history material itself must be organized and conceptualized.

They may be summarized under the following headings: (1) Cultural, (2) Biological, (3) Familial, (4) Biological-Cultural, (5) Developmental, (6) Situational, (7) Synthetical. The following table is my own interpretation of the results of Dollard's application to the six life histories which he analyzes.

In the following table plus signs indicate that Dollard believes the author has met the criterion indicated. The minus sign indicates that the criterion indicated has not been met, and a cross indicates that the criterion has been partially met or has been met in certain respects.

	Adler	Rank	Freud	Thomas Znaniecki	Shaw	Autobio- graphical Wells
I. Cultural	—	—	—	+	+	+
II. Biological	—	×	+	+	—	—
III. Familial	—	—	+	+	+	—
IV. Biological-Cultural	×	—	+	—	—	—
V. Developmental	+	+	+	×	×	—
VI. Situational	—	—	×	×	+	—
VII. Synthetical	—	—	+	+	+	—

It would seem as though Freud came out on top. On only one of the criteria, namely the cultural, does Dollard find Freud definitely lacking. He also believes that Freud tends to overlook somewhat present situational factors. He does find Freud, however, very strong in his analysis of the biological bases of human behavior and in his method of indicating how behavior grows out of the interaction of biological and cultural factors. He also believes that Freud is strong in having a well-knit system.

Freud fares better than the other psychoanalytical schools. Rank, he finds particularly weak. He believes that Rank's emphasis on the birth trauma is unnecessarily restricted and because of this emphasis he fails properly to assign value to other familial and cultural factors. Adler, he also finds to be rather unsystematic and indicates that there

are gaps in the logic which fails to describe how an individual reaches his present state from the biological and cultural materials with which he starts.

Dollard also rates high Thomas and Znaniecki's "Life Record of an Immigrant" taken from Volume II of the *Polish Peasant in Europe and America*. As might be expected, these writers are strong on the cultural antecedents of personality and with Thomas' development of the wishes as a biological basis for development Dollard believes that these authors have been successful in interpreting the course of development. Curiously enough he finds these writers weak on criterion IV. He says that the problem of how biological material is developed into social attitudes is avoided rather than clarified by Thomas and Znaniecki and he believes that they give little help in showing how temperament becomes character. Shaw is also strong on the cultural antecedents of personality but Dollard believes that Shaw's limitation is lack of an adequate concept of the biological bases of behavior.

If I interpret Dollard correctly, he believes that Wells' autobiography is somewhat of a failure when compared with these psychological and sociological studies. He is polite enough, however, to pay tribute to Wells' vigor in writing, and apologizes somewhat by saying that he is examining the autobiography from a very critical standpoint and that he knows very well that Wells had not written it with the idea of passing his (Dollard's) criteria.

The critical reviewer finds the book an exceedingly illuminating analysis and comparison of the several psychoanalytical and sociological schools of thought. The whole study rests, however, on the seven criteria selected and Dollard is rather vague as to how they originated. Nothing is stated in the book to indicate whence these criteria came and we must assume that the author alone is responsible for them, gathering them up from the wealth of his own previous experience. When one looks over the seven headings, it is evident that the criteria represent seven comprehensive emphases or points of view with which to regard individual development, but they themselves have come out of the culture of western psychological and sociological thought of the present time which emphasizes biological and cultural factors centering in the family. The reviewer, himself, is in the same culture and these factors seem reasonable, in fact the only ones that are imaginable. However, these criteria are, of necessity, relative to the particular culture and age in which we live, and another person writing at another time might give more or less

emphasis to the present situation, family background, developmental factors, or cultural factors than Dollard has chosen to do.

I should recommend Dollard's book to the psychology or sociology student as an easy way of becoming acquainted with the strengths and limitations of the various schools which have as their goal the clinical study of the individual.

PERCIVAL SYMONDS.

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JONES, V., *Character and Citizenship Training in the Public School: An Experimental Study of Three Specific Methods*. Chicago: The University of Chicago Press, 1936. Pp. xi+404.

The nature of this book is more accurately suggested by its subtitle than by its principal title, for instead of a generalized discussion of the problem, we find it to be hardly more than a clear, readable account of a carefully planned experiment, preceded by a brief historical foreword summarizing nine previous experiments, and followed by an even briefer chapter of conclusions and implications. The experiment was conducted in 1932-33 in two schools in New Haven, Connecticut, using four seventh-grade classes and four eighth-grade classes, numbering in all 304 children. For each of the three experimental conditions and control, one seventh-grade and one eighth-grade were used. Training was conducted as a part of the regular social-studies program, following a carefully planned curriculum of 13 units, by the regular classroom teachers under the tutelage and frequent observation of the experimenter. The three teaching methods compared are characterized as (1) the first-hand experiencing method, E, (2) the exclusive discussion method, D, and (3) a combination method, E-D, in which children had not only the benefit of direct participation, but of generalized discussion of their experiences.

The relative efficacy of the three methods was measured by means both of teachers' observational ratings and by a series of 17 tests, most of which were given twice, at the beginning and end of the school year. These may be classified as five tests of honesty and truthfulness, two of coöperation, two of moral standards and self-evaluation, and measures of intelligence, home background, and psychoneurotic tendencies. The remaining tests were used in connection with three supplementary studies, one on change of pupil-attitudes after seeing motion pictures, one a retest six months after the principal experiment, and a general social-studies test to discover

whether the inclusion of the experimental curriculum had seriously detracted from the regular social-studies program (estimated to be less than 5%). The curriculum and methods are described in considerable detail in an eighty-three-page chapter, which it is suggested may prove of help to others who would like to repeat the experiment in their own schools.

In general, the author found the E-D method distinctly more effective than either of the other two methods, and the only one consistently superior to the control groups on any of the tests. Even this method, however, did not produce better scores on all the tests, improvement being most noticeable in those which most closely resembled some part of the training program.

The book is to be praised for its clear, orderly presentation, its well-phrased chapter summaries, and its honesty in stating the weaknesses and limitations of the experiment, as well as its positive findings. Thus, although the author definitely aligns himself with those who believe that the schools should attack the problem of individual character training more directly and seriously before abandoning the effort in favor of a reorganization of the social order, he is frank enough to admit that even the most encouraging results of his own and others' experimental programs fall far short of satisfactory. Nevertheless, he has definitely shown that the problem is not yet to be dismissed as insoluble.

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CHASSELL, C. F., *The Relation Between Morality and Intellect: A Compendium of Evidence Contributed by Psychology, Criminology, and Sociology*. New York: Bureau of Publications, Teachers College, Columbia University. Teachers College Contributions to Education, 1935. No. 607. Pp. xviii+556.

This volume consists of three separate studies. Part I, which is probably of most general interest, is the "Compendium" referred to in the subtitle. Parts II and III are detailed accounts of two series of researches conducted by the author in the years 1917 to 1919, the first of which was based on correlations among faculty and student ratings of 498 college seniors in 16 colleges, as to moral traits and intellect; the second, on conduct ratings and intelligence scores of public and private school pupils.

In Part I (to which this review will be confined) nearly 300 quantitative studies have been summarized in tabular form, compris-

ing nearly 700 coefficients of various types, calculated between measures of morality and intellect, for three types of subjects, numbering 11,052 feeble-minded, 296,281 delinquents, and 11,828 non-delinquents. These studies fall into two broad classes; I-A, studies of the relation between delinquency and mental inferiority (generally non-correlational); and I-B, studies of the relation between moral character and intelligence (correlational).

The distinctive feature of this compendium is the reduction of the diverse results of many investigations to comparable form. In Part I-A this has been accomplished through the use of two statistical devices, calculation of pooled percentages (weighted), and calculation of coefficients of colligation (Yule's *omega*) corresponding to these percentages; and also by the employment of a standard pattern of tabulation and interpretation. By means of these devices, an enormous and scattered body of results can be directly compared and synthesized and trends readily visualized.

In Part I-B, dealing with morality and intelligence at non-delinquent levels, most of the results cited were already in some kind of correlational terms. Five types of coefficient are found, product-moment correlations, rank-difference correlations, tetrachoric correlations, correlation ratios, and coefficients of colligation; and these are tabulated separately.

The heart of this study is to be found, therefore, in some seventy pages of tabulation. Indeed the author has chosen to let the tables tell most of their own story, and she goes little beyond them, further than to explain her procedures, summarize trends, and point out the many factors which affect correlational results in this field. In short, the volume is that *rara avis* of ethical literature, a study of morality almost 100% quantitative.

Naturally, the synthesis of so many studies, diversely motivated, and varying widely as to conditions, subjects, and criteria, inevitably raises the question of the legitimacy of assimilating such dissimilars. The author is well aware of this difficulty, and in her effort to produce significant syntheses has cross-classified the studies in several ways—as to types of evidence (*i.e.* varying criteria, both of morality and intellect), types of subjects, countries, and types of coefficients employed. She has also pointed out at length the effects of factors which vary from study to study; in Part I-B, for example, 20 such factors are examined. Nevertheless, one leaves a perusal of the tables with the feeling that, valuable as such a compendium undoubtedly is, one cannot afford to overlook the differences between the original researches.

In the face of such an enormous undertaking as this, enormous both in magnitude and importance, to point out seeming defects seems carping. The volume is distinctly not designed as a book for popular consumption (and this is perhaps more of a virtue than a defect); but its painstakingly—perhaps unnecessarily—detailed exposition and justification of procedures makes for a somewhat repetitious style. Ease and smoothness of reading, moreover, is not promoted by the abundance of footnotes, 529 of them, not counting those in the tables or appendices. This fault, of course, is a common one, but one which writers might well strive to minimize, perhaps by incorporation of some into the text, and transferring the rest to the end of the chapter where they will be less likely to disrupt the continuity of the reading.

In spite of these minor criticisms, the author has done a piece of work which even the most critical must find useful and suggestive. It will undoubtedly take high place among reference books in this field. It will render an inestimable service in raising a barrier of stubborn fact against those who assert that morality is nothing but intellect, as well as against those who would make it nothing but emotion. The author's conclusion is summarized thus (p. 470):

"The relation between morality and intellect in restricted groups is clearly direct. The obtained relation is extremely variable, but tends to be low. It is dependent upon the type of evidence, the type of group, the type of coefficient, and possibly even the country represented. The true relation is undoubtedly higher than the obtained relation, but apparently at best it tends to be only marked [*i.e.* .40 to .70] and frequently it tends to be low. Expressed in correlational terms, the obtained relation may therefore usually be expected to fall between .10 and .39, and the true relation to be under .50. . . . [As for unrestricted groups, for whom data are scarce.] . . . Undoubtedly the relation between morality and intellect in the general population is considerably higher than that usually found in restricted groups. Nevertheless, it is hardly probable that this relation is high. Expressed in correlational terms, the relation in the general population may therefore be expected to fall below .70."

F. A. KINGSBURY.

*The University of Chicago.*

HESS, J. H., MOHR, G. J., and BARTELME, P. F., *The Physical and Mental Growth of Prematurely Born Children*. Chicago: University of Chicago Press, 1934. Pp. xxiii+449.

In Part I of this extensive group of studies of prematurely born infants, Dr. Hess describes the equipment and history of the Premature Infant Station at Sarah Morris Hospital of Michael Reese

Hospital in Chicago, and presents a statistical analysis of the case material gathered during the first twelve years after its establishment. In Part II, Drs. Mohr and Bartelme report the results of their follow-up developmental examinations of 250 graduates of the Station. Part III consists of a group of ten special studies by various authors on miscellaneous problems associated with prematurity of birth.

From its establishment in 1922 up to 1934, 1,623 infants were admitted to the Station, with 200 re-admissions. In the case of the original admissions, 488 of the infants died, while of the 1,135 who were graduated, 92 are known to have died later. The fact that this relatively high survival record is due in large part to innovations in technique devised by Dr. Hess himself and his co-workers is not brought out in the text, the figures being allowed to speak for themselves. Detailed analyses are given of etiologic factors influencing termination of pregnancy, and of morbidity and mortality in the infants, both during the first admission to the Station and, as far as possible, after graduation.

Especial effort has been made to maintain long follow-up contacts with as many of the graduates as possible, and these contacts have furnished the material for the developmental studies carried on by Dr. Mohr and Dr. Bartelme. They were begun in 1928, and have involved repeated examinations of 250 white graduates, together with examinations of their siblings for purposes of comparison. The authors point out that age factors have limited their findings; the oldest graduate examined was nine and one-half years of age, and about one-sixth of the children had reached grade school. Development during the preschool years has been carefully studied, however, and from ages one year to seven years, inclusive, enough examinations have been made to justify certain definite conclusions.

These studies of physical and mental growth, including habit-formation and social adjustment, are extensively reported and elaborately documented. The psychometric data confirm earlier, but less extensive, investigations in indicating that premature birth does not affect mental development except in cases involving intracranial injury. No demonstrable relationship was found between degree of prematurity and general intelligence, nor was there any statistically reliable difference between the mean scores of groups with low birth weights as opposed to those with higher weights. Children born with lues or heart conditions tended to earn lower ratings on mental tests, but this tendency may very probably be associated with the

conditions themselves, irrespective of prematurity. Dr. Bartelme concludes "that for surviving children, if weight at birth and duration of the period of gestation are used as criteria, prematurity *per se* and degree of prematurity are not related to mental development according to the mental tests here employed and within the age range tested."

There are, of course, many cases of intracranial hemorrhage among children born prematurely. Of 69 such cases in the developmental study group, 14 were found to be definitely defective, 12 to be retarded, and 47 to be of average intelligence.

The prematurely born children, as compared with their siblings, seem to be slightly later in walking, in the development of sphincter control (especially among the boys), and in the development of independent feeding habits. In these, as in other comparisons on an age basis, allowance is made for the difference in total age resulting from the prematurity of birth. The premature group show more dependency in relation to their mothers, more frequent temper display, and a greater frequency of speech defects, particularly stuttering. The full-term children are reported by their parents to be somewhat more adequate in their earliest social responses (to their siblings), and more self-reliant in their later contacts. No difference was found between the two groups compared with respect to establishment of language, or early nursing and feeding habits. The limited data on those children who have reached school age indicate that there is probably no difference in school achievement.

B. M. CASTNER.

*Yale University.*

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## NOTES AND NEWS

THE honorary degree of LL.D. was conferred upon Professor Edward L. Thorndike of Columbia University by the University of Edinburgh on July 3.

DR. WILLIAM BROWN has been appointed the first director of the new Institute of Experimental Psychology at the University of Oxford.—From *Science*.

PROFESSOR CARL MURCHISON has resigned his position as professor of psychology and chairman of the department at Clark University as of September 1, 1936, and as director of the Clark University Press as of January 1, 1937. Professor Murchison has resigned in order to devote himself intensively to the group of psychological journals which he edits.

BEGINNING with January, 1937, the *Journal of Experimental Psychology* will be published *monthly*. There will be two volumes a year at \$7.00 per volume. This change has been made to facilitate the publication of experimental papers.



## INDEX OF SUBJECTS

---

- Abnormalities, Functional, of Memory with Special Reference to Amnesia, 229
- American Psychological Association
  - Financial Reports of Publication Enterprises of, 224
  - Proceedings of, 677
  - Publication Lag in the Publications of, 581
- Amnesia, Functional Abnormalities of Memory with Special Reference to, 229
- Audition, A Critical Review of the Field of, 407
- Blood-Pressure, The Galvanic Skin Reflex (Sweating) and, as Preparatory and Facilitative Functions, 73
- Color Vision, Defects of: Their Vocational Incidence and Practical Control; Acquired Defects, 448
- Defects of Color Vision: Their Vocational Incidence and Practical Control; Acquired Defects, 448
- Disordered Persons, Psychological Experiments with, 1
- Eastern Branch, American Psychological Association, Proceedings of, 591
- Eye Movement, Perception, and Legibility in Reading, 275
- Facilitative Functions, The Galvanic Skin Reflex (Sweating) and Blood-Pressure as Preparatory and, 73
- Financial Reports of Publication Enterprises of the American Psychological Association, 224
- Galvanic Skin Reflex (Sweating) and Blood-Pressure as Preparatory and Facilitative Functions, The, 73
- Hunger, The Importance of, in the Bodily Activity of the Neonate, 817
- Intelligence, The Neuro-physiological Correlates of Learning and, 479
- Journals, The Influence and Dependence of Psychological, on Each Other, 95
- Language, The Psychology of, 178
- Learning
  - The Methodology of Experimental Studies of Human, and Retention: I. The Functions of a Methodology and the Available Criteria for Evaluating Different Experimental Methods, 305
  - The Neuro-physiological Correlates of, and Intelligence, 479
- Legibility, Eye Movement, Perception and, in Reading, 275
- Matching Method Applied to Investigations of Personality, The, 149
- Memory, Functional Abnormalities of, with Special Reference to Amnesia, 229
- Methodology of Experimental Studies of Human Learning and Retention: I. The Functions of a Methodology and the Available Criteria for Evaluating Different Experimental Methods, The, 305
- Midwestern Psychological Association, Proceedings of, 631
- Neonate, The Importance of Hunger in the Bodily Activity of the, 817
- Neuro-physiological Correlates of Learning and Intelligence, The, 479
- Pavlov's Contribution to Psychology, 583
- Perception, Eye Movement, and Legibility in Reading, 275
- Personality, The Matching Method Applied to Investigations of, 149

- Proceedings  
   American Psychological Association, 677  
   Eastern Branch, American Psychological Association, 591  
   Midwestern Psychological Association, 631  
   Rocky Mountain Branch of the American Psychological Association, 638  
   Southern Society for Philosophy and Psychology, 625  
   Western Psychological Association, 618  
 Proprioceptive Systems, Functional Relationships in Tactual and, 432  
 Psychological Journals, The Influence and Dependence of, on Each Other, 95  
 Psychology  
   A Symposium on Convergent Trends in, Held at the University of Southern California, 146  
   Pavlov's Contribution to, 583  
 Publication Lag in the Publications of the American Psychological Association, 581  
 Reading, Eye Movement, Perception, and Legibility in, 275  
 Retention, The Methodology of Experimental Studies of Human Learning and, I. The Functions of a Methodology and the Available Criteria for Evaluating Different Experimental Methods, 305  
 Rocky Mountain Branch of the American Psychological Association, Proceedings of, 638  
 Southern Society for Philosophy and Psychology, Proceedings of, 625  
 (Sweating), The Galvanic Skin Reflex, and Blood-Pressure as Preparatory and Facilitative Functions, 73  
 Tactual, Functional Relationships in, and Proprioceptive Systems, 432  
 Vision, Defects of Color, Their Vocational Incidence and Practical Control; Acquired Defects, 448  
 Vocational Incidence, Defects of Color Vision: Their, and Practical Control; Acquired Defects, 448  
 Western Psychological Association, Proceedings of, 618

## INDEX OF AUTHORS

---

### ORIGINAL CONTRIBUTIONS, SHORT ARTICLES, AND NOTES

- |                        |                      |
|------------------------|----------------------|
| Bills, A. G., 631      | Paterson, D. G., 677 |
| Cason, H., 95          | Richards, T. W., 817 |
| Darrow, C. W., 73      | Rogers, H. W., 591   |
| Harlow, H. F., 479     | Ruckmick, C. A., 407 |
| Hilgard, E. R., 146    | Sears, R. R., 229    |
| Howells, T. H., 638    | Tinker, M. A., 275   |
| Hunt, J. McV., 1       | Tryon, R. C., 618    |
| Lanier, L. H., 625     | Turner, W. D., 448   |
| Liddell, H. S., 583    | Vernon, P. E., 149   |
| Lubotsky, M., 95       | Zigler, M. J., 432   |
| McGranahan, D. V., 178 |                      |
| Melton, A. W., 305     |                      |

### BOOKS REVIEWED

- |                       |                          |
|-----------------------|--------------------------|
| Baker, K. H., 472     | Haggard, H. W., 667      |
| Banister, H., 138     | Hartmann, G., 541        |
| Bartelme, P. F., 844  | Hess, J. H., 844         |
| Bentley, A. F., 544   | Hoisington, L. B., 112   |
| Blumel, C. S., 141    | Hollingworth, H. L., 132 |
| Buswell, G. T., 142   | Jacobson, E., 563        |
| Carr, H. A., 465      | Jastrow, J., 672         |
| Chassell, C. F., 842  | Jenkins, T. N., 471      |
| Cole, L., 659         | Jones, V., 841           |
| Collins, M., 576      | Klineberg, O., 129       |
| Conklin, E. S., 569   | Koffka, K., 59           |
| Crawley, S. L., 472   | Latour, M., 555          |
| Dale, E., 143         | Lewin, K., 548           |
| Dewey, E., 298        | Ligon, E. M., 133        |
| Dockeray, F. C., 669  | Maier, N. R. F., 467     |
| Dollard, J., 838      | McBride, K. E., 291      |
| Doob, L. W., 552      | McGraw, M. B., 104       |
| Dorsey, J. M., 296    | Melton, A. W., 654       |
| Dreyer, J., 576       | Mohr, G. J., 844         |
| Dunbar, H. F., 558    | Morgan, J. J. B., 137    |
| Duncker, K., 128      | Murchison, C., 526       |
| Ebaugh, F. G., 135    | Perry, R. B., 640        |
| Finner, P. F., 472    | Rusu, L., 567            |
| Fite, W., 126         | Schneirla, T. C., 467    |
| Freeman, E., 664      | Seashore, C. E., 119     |
| Fry, C. C., 667       | Seashore, R. H., 119     |
| Gray, J. S., 119      |                          |
| Griffiths, J. H., 114 |                          |

Seligman, E. R. A., 217  
 Shaffer, L. F., 574  
 Skaggs, E. B., 116  
 Skinner, C. E., 117, 836  
 Stanton, F. N., 472  
 Stern, W., 652  
 Strecker, E. A., 135  
 Stroud, J. B., 123

Taylor, J. H., 472  
 Thurstone, L. L., 395

Valentine, W. L., 472  
 Wallin, J. E. W., 294  
 Warden, C. J., 471  
 Warner, L. H., 471  
 Wechsler, D., 108  
 Weisenburg, T., 291  
 Westcott-Wieman, R., 300  
 Wieman, H. N., 300  
 Wile, I. S., 139  
 Zipf, G. K., 218

## BOOK REVIEWERS

Allport, F. H., 654  
 Allport, G. W., 218  
 Angier, R. P., 640

Bills, A. G., 112  
 Boring, E. G., 59  
 Bott, E. A., 569  
 Brown, A. W., 123  
 Brown, J. F., 544  
 Brown, W., 465  
 Burtt, H. E., 576

Castner, B. M., 844  
 Chant, S. N. F., 294  
 Conklin, E. S., 296

Darrow, C. W., 558

Ehrenfest, F. H., 143

Farnsworth, P. R., 552

Garrett, H. E., 395  
 Gibson, J. J., 664  
 Guthrie, E. R., 574

Heidbreder, E., 541  
 Heiser, F., 472  
 Hilgard, E. R., 116  
 Hutchinson, E. D., 567

Jenkins, J. G., 667  
 Johnson, H. M., 563  
 Jones, V., 119

Kelly, E. L., 672  
 Kingsbury, F. A., 133, 841, 842  
 Kirkpatrick, F. H., 132

Landis, C., 135  
 Lanier, L. H., 119, 129  
 Leeper, R., 467

MacLeod, R. B., 652  
 Miner, J. B., 669  
 Morgan, J. J. B., 141  
 Mullett, C. F., 126

Peak, H., 108  
 Peters, H. N., 555  
 Pillsbury, W. B., 836  
 Porteus, S. D., 139  
 Pratt, C. C., 128

Rexroad, C. N., 117

Schanck, R. L., 217  
 Sears, R. R., 137, 138, 548  
 Stone, C. P., 471  
 Symonds, P. M., 838

Thompson, H., 298  
 Tinker, M. A., 142

Weld, H. P., 526  
 Wellman, B. L., 104  
 Wells, F. L., 291  
 Wells, G. R., 300  
 Whitely, P. L., 114  
 Wolfe, J. B., 659

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